Technical language of electrical engineering

Present by Mohammad reza sheibani

Definition of engineering

Engineering is the application of scientific, economic, social, and practical knowledge in order to invent, design, build, maintain, research, and improve structures, machines, devices, systems, materials and processes.

Definition of electrical engineering

The design and study of various electrical systems, such as electrical circuits, generators, motors, optical fibers, computer systems and controls.

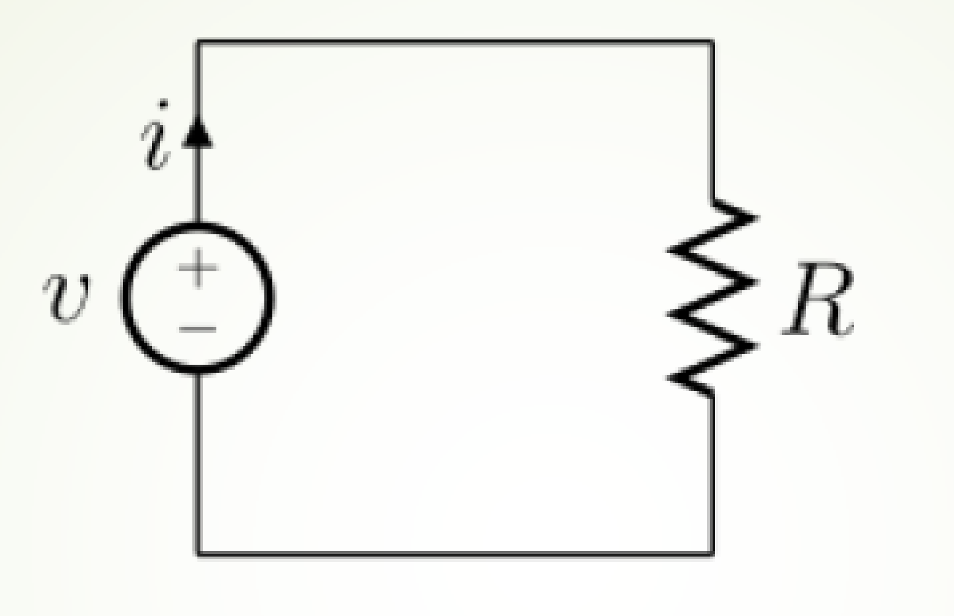
Definition of power engineering

Power engineering deals with the generation, transmission and distribution of electricity. These include transformers, electric generators, electric motors, high voltage engineering, and power electronics. In many regions of the world, governments maintain an electrical network called a power grid that connects a variety of generators together with users of their energy. Users purchase electrical energy from the grid, avoiding the costly exercise of having to generate their own. Power engineers may work on the design and maintenance of the power grid.

An atom is the smallest unit of matter that defines the chemical elements. Every solid, liquid, gas, made up of neutral or ionized atoms. Atoms are very small: the size of atoms is measured in Pico meters.

Every atom is composed of a nucleus made of one or more protons and usually an equal or similar number of neutrons. The protons have a positive electric charge, the electrons have a negative electric charge, and the neutrons have no electric charge. If the number of protons and electrons are equal, that atom is electrically neutral. If an atom has a surplus then it has an overall positive or negative charge, and is called an ion.

Electrical variables

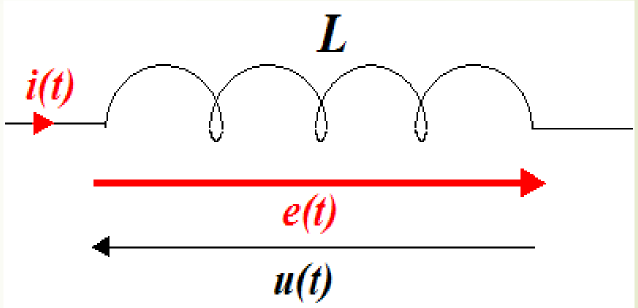


A simple electric **circuit**, where **current** is represented by the letter I. The relationship between the voltage (V), **resistance**(R), and current(I) is V=IR; this is known as Ohm's Law

inductor

Inductors are typically manufactured out of coils of wire. The relationship between the self-inductance L of an electrical circuit (in henries), voltage, and current is:

$$v(t) = L\frac{di}{dt}$$

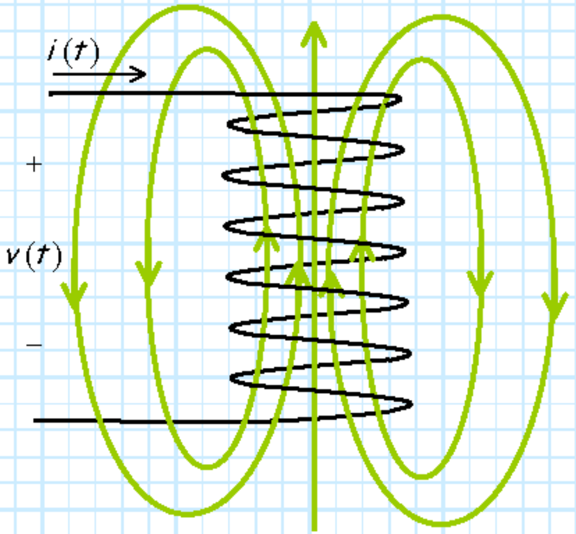


Where v(t) denotes the voltage in volts across the circuit and i(t) the current in amperes through the circuit.

The formula implicitly states that a voltage is induced across an inductor, equal to the product of the inductor's inductance, and current's rate of change through the inductor.

Inductance

Consider a **solenoid** with N turns:



The current i(t) in flowing in the wire will produce a time-varying magnetic flux density within the solenoid. This time-varying magnetic flux density will **induce a voltage** $v(t)$ across the solenoid.

This voltage can be determined using **Faraday's Law**:

$$-\oint_{C_1} \mathbf{E}(\bar{r}) \cdot \overline{d\ell} = \frac{\partial}{\partial t} \iint_{S_1} \mathbf{B}(\bar{r}) \cdot \overline{ds}$$

capacitor

A capacitor consists of two conductors separated by a non-conductive region. The non-conductive region is called the dielectric. In simpler terms, the dielectric is just an electrical insulator. Examples of dielectric media are glass, air, paper, vacuum. In SI (System International) units, a capacitance of one farad means that one coulomb of charge on each conductor causes a voltage of one volt across the device. An ideal capacitor is wholly characterized by a constant capacitance C, defined as the ratio of charge ±Q on each conductor to the voltage V between them:

$$C = \frac{Q}{V}$$